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The work presented in [1,2] was extended with the objective of formulating the differential equations of motion for both extensional and inextensional rotor blades including the effect of cubic non-linearities. A detailed report on this work was prepared and published in a form suitable for distribution [3].

One question that came up during this investigation pertained the meaning of "inextensionality." That is to say, when the blade is approximated as inextensional--for which case the product (EA) of Young's modulus for the blade's material and the blade's cross sectional area does not appear in the equations of motion--"which line along the blade's span is the inextensional line?" The answer to this question is important for correctly formulating the equations for such case when the inextensionality assumption is imposed a priori. It seems that this question has not been properly addressed in the literature and that some confusion exists, as exemplified by the work in [4] where inextensionality is merely taken to mean that the elastic axis through the blade's cross sections shear centers along its span is the inextensional line. As shown in [3] for the case of an isotropic blade, this does not hold true in general.

The differential equations developed in [3] are formally reduced to a set of three integro partial differential equations for a hingeless blade by elimination of the "extension" variable. Both cases of hover and forward flight are addressed. The

generalized aerodynamic forces are modelled using Greenberg's extension of Theodorsen's strip theory. After the equations of motion are obtained, they are systematically expanded into polynomial non-linearities with the objective of retaining all terms up to third-degree so that the influence of such terms on the motion of the system may be evaluated. The blade is modelled as a long, slender, initially straight beam of isotropic Hookean material. Offsets from the blade's elastic axis through its shear center and the axes for the mass, area and aerodynamic centers, as well as radial non-uniformities of the blade's stiffnesses and cross section properties are taken into account. The effect of warp is also included in the formulation.

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